Water for the World

Operating and Maintaining a Landfill

Technical Note No. SAN. 3.0.1

A landfill is a means of disposing of solid waste by burying it. This prevents contamination of water supplies and breeding of flies and rats which may spread disease to people in the community. A landfill eliminates the unpleasant odors and unsightliness of solid waste. Operating a landfill involves excavating cover soil, placing wastes in piles, strips, or layers, compacting the waste, and covering it with the excavated soil. Maintaining a landfill involves inspection and repair of damage to the landfill and access road. Success of a landfill depends on compacting the waste and having good and ample soil to it.

This technical note describes how to operate and maintain a landfill. Read the entire technical note before beginning operation.

Materials Needed

The project designer must provide three papers before operation can begin:

1. Location map similar to Figure 1, showing the site for the landfill in relation to dwellings, water wells, streams, roads, and so on.

Useful Definitions

CONTAMINATE - To make unclean by introducing an infectious (disease-causing) substance such as leachate or bacteria from animal manure.

GARBAGE - Food and crop wastes from growing, harvesting, storing, preparing, cooking, or serving of food; these materials rot quite quickly.

LEACHATE - A liquid formed when rain, surface water, or ground water passes through a landfill and accumulates dissolved and suspended matter or organic wastes; leachate can contaminate water supplies.

RUBBISH - All material other than garbage that is thrown away, including broken dishes, utensils, and furniture; useless scraps of wood, metal, or glass; sweepings from house, yard, or street; and anything else that is discarded.

SOLID WASTE - Garbage, rubbish, animal manure, dead animals, and ashes.

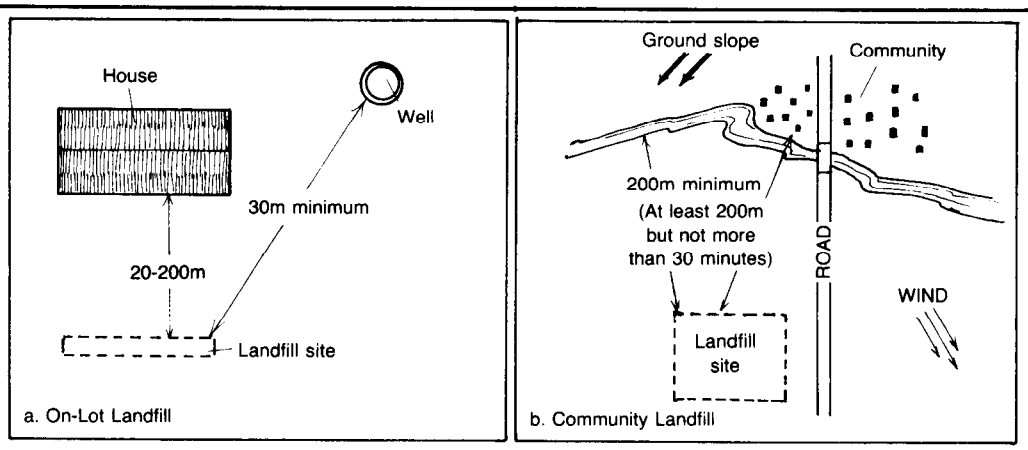

Figure 1. Location Map

2. Design drawings similar to one or more of Figures 2, 3, and 4, showing the dimensions of the landfill.

3. Materials list similar to Table 1, showing all personnel and equipment needed to operate the landfill.

You will also need:

4. The personnel and equipment described in the materials list.

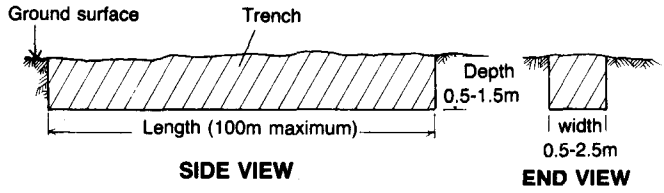

Figure 2. Trench Landfill

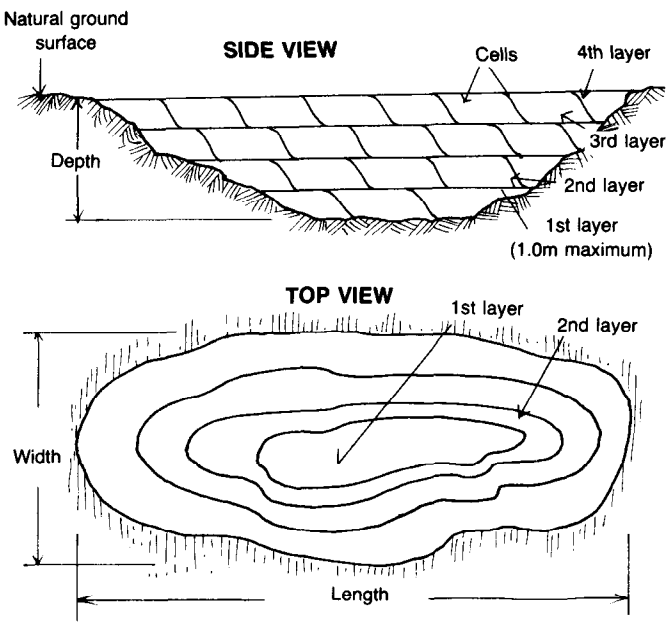

Figure 3. Area Landfill

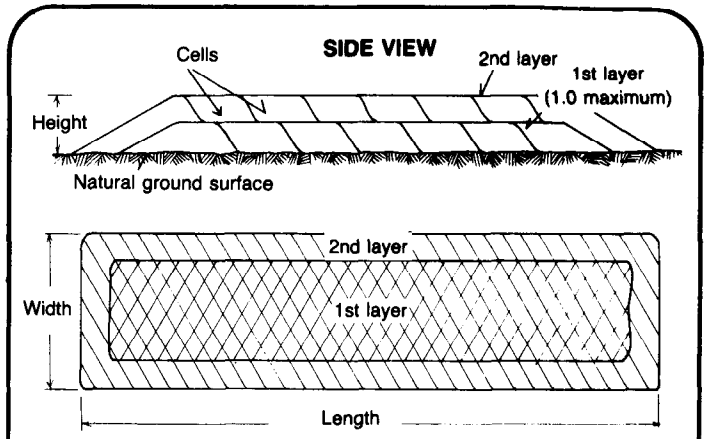

Figure 4. Mound Landfill

Table 1. Sample Materials List

Item	Description	Quantity	Estimated Cost
Labor	Foreman (for 5 years)	1	____
	Workers (for 5 years)	4	____
Equipment	Tape measure	____	____
	Animal-drawn plow or scoop	____	____
	Animal-drawn cart to transport cover soil	____	____
	Animals	____	____
	Shovels	____	____
	Rakes	____	____
	First-aid kit	____	____
	Boots	____pairs	____
	Gloves	____pairs	____
	Vehicle with tires, sled or paddles for compaction	____	____

Total Estimated Cost = ____

Caution!

Care must be taken when handling solid wastes to prevent cuts from sharp-edged scraps and to prevent injuries from lifting heavy objects and containers. Boots and gloves should be worn by workers and community members using the landfill.

Cleanliness is important to prevent the spread of disease. Workers, community members, and householders should wash their hands after handling solid wastes, especially before preparing or eating food.

Operating On-Lot Landfills

Trench Method

1. Using the location map, design drawings, and measuring tape, locate the site and mark the dimensions of the trench on the ground. Set wooden stakes or pointed sticks at the corners and along the sides of the trench. These stakes may have to be replaced from time to time because the trench is designed to last at least five years. See Figure 5.

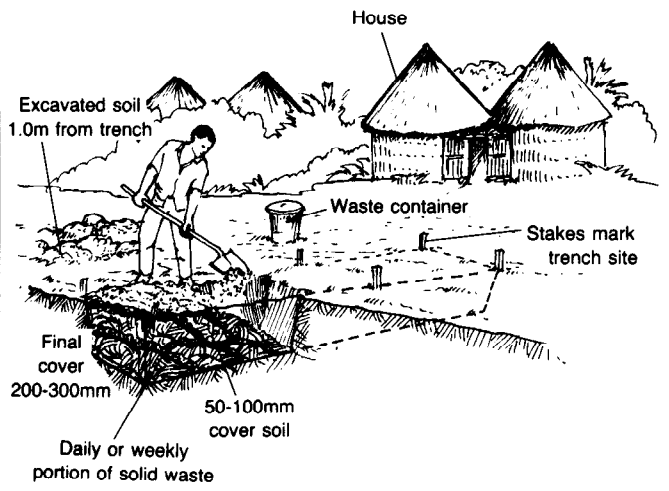

Figure 5. On-Lot Trench Method

2. Begin excavating the trench at one end. Dig to the design width and depth of the trench to avoid contaminating ground water with leachate. Dig only about 1.0m of the design length. If the entire trench length is dug, it may gradually fill with soil due to wind and rain erosion and have to be re-excavated.

3. Pile excavated soil about 1.0m from the edge of the trench to allow a person to move between the soil and the trench. See Figure 5.

4. Daily or weekly, dump garbage or other solid waste in the trench, starting at the end, and cover with 50-100mm of soil. Do not leave exposed solid waste in the trench. Compact it and cover immediately. See Figure 5.

5. When the toe of the waste and cover soil nears the unexcavated portion of the trench, dig another meter or so of length to the design width and depth. This may be two to eight months after the initial excavation, depending on the amount of solid waste and the design of the trench.

6. When the waste and cover soil have nearly risen to the original ground surface, place a final cover on it of 200-300mm of soil or composted material as shown in Figure 5. See "Operating and Maintaining Compost Toilets," SAN.1.0.6, and "Operating and Maintaining a Composting System," SAN.3.0.2.

Area Method

1. Using the location map, design drawings, and measuring tape, locate the site and mark the boundaries of the depression or low spot with wooden stakes or pointed sticks. See Figure 6.

2. Excavate cover soil from the bottom and sides of the depression or from nearby higher ground. Pile it near the edge of the depression.

3. Daily or weekly, dump solid waste in the depression, rake it fairly level, and cover with 50-100mm of soil. See Figure 6.

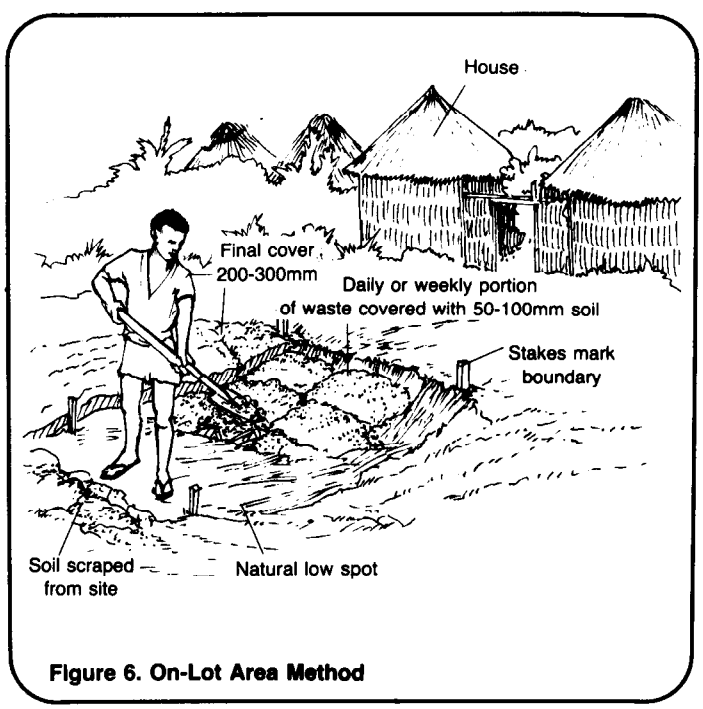

Figure 6. On-Lot Area Method

4. When the waste and cover soil reach the designed height of the fill, place a final cover on it of 200-300mm of soil or composted material.

Mound Method

This method may not be suitable for on-lot disposal. It is generally easier to haul solid waste to an off-lot site than to haul cover soil onto the lot.

Operating Community Landfills

Trench Method

1. Using the location map, design drawings, and measuring tape, locate the site and mark the dimensions of the trench on the ground. Set wooden stakes at the corners and along the sides of the trench.

2. If the site is not along a road, an access road will have to be constructed. If there are no paid workers, this should be a community effort. Clear off vegetation along a path from the nearest road to the site and spread gravel, crushed rock, cinders, or equivalent on it. Make the access road wide enough for two vehicles or carts to pass. Improve the road from the community to the site or the access road with gravel or equivalent to ensure that it remains open in wet weather.

3. Begin excavating the trench at one end. If there are no paid workers, this should be a community effort with one or more days set aside for the work. The excavation could be done with shovels, but animal-drawn plows and scoops or mechanized equipment, if available, may be preferable. Dig to the design width and depth of the trench, but only about one-fifth to one-tenth of the length. If the entire trench length is excavated, it may fill with soil due to wind and rain erosion and have to be re-excavated. This will contain about six to twelve months' accumulation of the community's solid waste. See Figure 7.

4. Pile excavated soil 1-2m from the side of the trench to allow movement of carts between the soil and the trench.

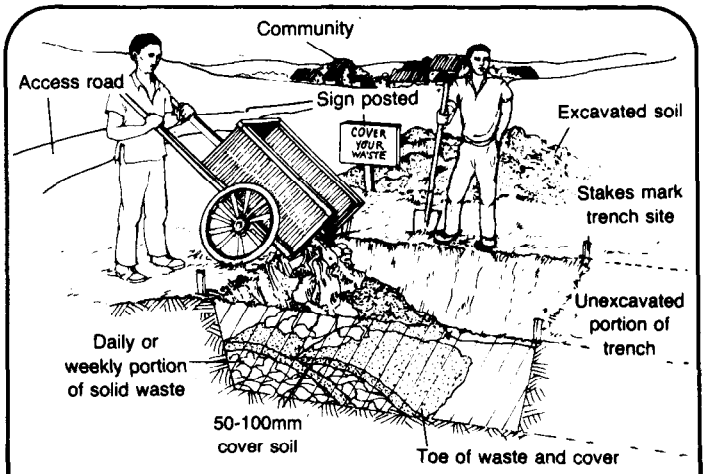

Figure 7. Community Trench Method

5. The landfill is now ready for use. It can be operated daily with individuals from the community freely disposing of waste and covering it with soil. Or it can be operated on a more controlled basis, with access to the landfill limited to once or twice a week with a volunteer supervisor present. The latter method will better ensure proper use of the landfill. If the landfill is operated by paid workers, they will be responsible for its proper use. These may be the same workers who collect solid waste in the community and transport it to the landfill. See "Operating a Solid Waste Collection System," SAN.3.0.3.

6. Post signs that inform the community of the days and hours that the landfill is open, and that remind the users to "Cover Your Waste!" If solid waste is left exposed in the trench, it is an open dump and not a landfill. An open dump is a health hazard; it is a breeding place for rats and flies and a physical hazard to children.

7. Have the community members or paid workers dump solid waste in the trench, beginning at the end, compact it, and cover it with 50-100mm of soil.

8. When the toe of the waste and cover soil nears the unexcavated portion of the trench, usually after at least six months, dig another one-fifth to one-tenth of the trench length of the design width and depth. This should be a community effort if it is not done by paid workers. See Figure 7.

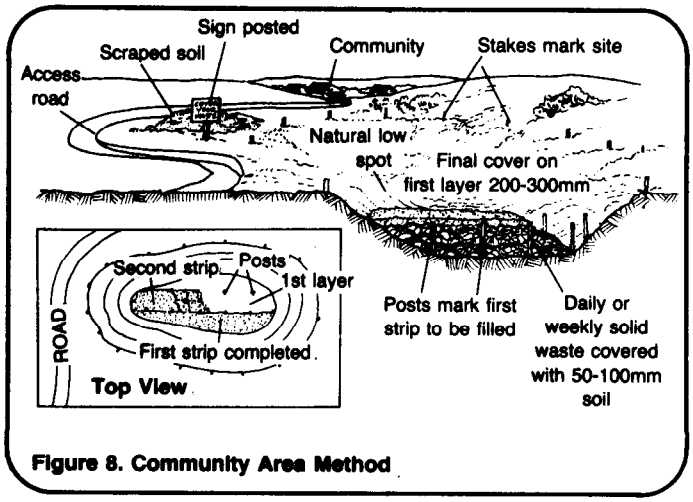

Figure 8. Community Area Method

9. When the waste and cover soil have nearly risen to the orginial ground surface, cover it with at least 300mm of cover soil or composted material. See "Operating and Maintaining Compost Toilets," SAN.1.0.6, and "Operating and Maintaining a Composting System," SAN.3.0.2.

Area Method

1. Using the location map, design drawings, and measuring tape, locate the site and mark the boundaries of the depression or low spot with wooden stakes. See Figure 8.

2. Improve the access road. See step #2 for "Trench Method."

3. Scrape or excavate cover soil from within the depression or from nearby higher ground. If there are no paid workers, this should be a community effort. Pile the excavated soil near the edge of the depression but out of the way of traffic to and from the landfill.

4. If the depression is to be filled in strips or layers, set posts, poles, or long sticks to mark the boundaries and height of the first layer or strip. See Figure 8.

5. The landfill is now ready for use. See step #5 for "Trench Method."

6. Post informative and instructional signs. See step #6 for "Trench Method."

7. Have the community members or paid workers dump solid waste within the boundaries of the layer or strip, rake it fairly level, compact it, and cover with 50-100mm of soil.

8. As each portion of the layer or strip nearly reaches the design height, cover with 200-300mm of soil and extend the access road onto the filled portion. Wheel the carts or vehicles over the filled area and dump waste at the working face of the layer or strip. If necessary, lay down logs, bamboo matting, or equivalent, to prevent vehicles from sinking in. See Figure 8.

9. When the first layer or strip has been completed, set posts, poles, or long sticks to mark the boundaries and height of the second layer or strip.

10. When the landfill nearly reaches its designed height, compact it, and cover with at least 300mm of soil or composted material.

Mound Method

1. Using the location map, design drawings and measuring tape, locate the site and mark the boundaries with wooden stakes. See Figure 9.

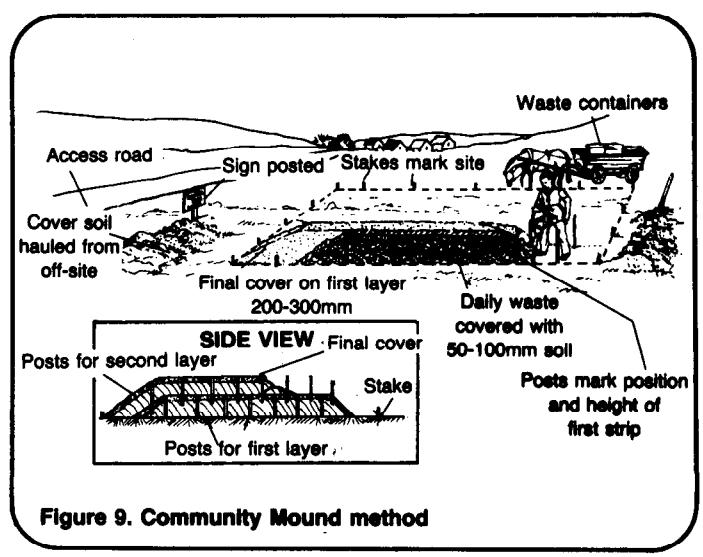

Figure 9. Community Mound method

2. Improve the access road. See step #2 for "Trench Method."

3. Scrape or excavate cover soil and haul it to the site. If there are no paid workers, this should be a community effort. Pile excavated soil so that it is readily available yet does not impede the flow of traffic.

4. Set posts, poles, or long sticks to mark the boundaries and height of the first strip. See Figure 9.

5. The landfill is now ready for use. See step #5 for "Trench Method."

6. Post informative and instructional signs. See step #6 for "Trench Method."

7. Have communtiy members or paid workers dump solid waste within the boundaries of the first strip, rake it fairly level, compact it, and cover with 50-100mm of soil.

8. As the first layer reaches its designed height, cover with 200-300mm of soil if the mound is to be multi-layered. If the mound is to be single-layered, cover with at least 300mm of soil or composted material. See Figure 9.

9. When the first strip has been completed, set posts, poles, or long sticks to mark the boundaries and height of the second strip. If the landfill is to be multi-layered, carts or vehicles must be wheeled onto the first layer. If necessary, lay down logs, bamboo matting, or equivalent, to prevent vehicles from sinking in.

10. When the landfill reaches its designed height, compact it, and cover with at least 300mm of soil or composted material.

Maintaining a Landfill

Maintaining a landfill involves inspection and repair of the site and access road during operation and preparation for final use of the site after completion.

Inspection and Repair

Keep the surface of the landfill fairly smooth and level during operation. This makes it easier to find damage due to erosion or burrowing animals. Inspect the surface of the landfill once a month and after heavy rains. Fill in with soil any eroded areas and holes made by burrowing animals. If burrowing animals are a constant problem, set traps or erect fences to keep them away. Surface water should not be allowed to flow over the landfill. If necessary, divert water with shallow trenches or small dams.

Inspect the access road once a month and after heavy rains. Repair eroded areas with soil, sand, and gravel, or equivalent.

Operation

When the landfill has reached its designed limits of length, width, and height, a new landfill will have to be designed and put into operation. The new site may or may not be adjacent to the old one. Consult the project designer.

Plant grass or similar vegetation on the top and sides of the completed landfill. The area may be used for a park, soccer field, grazing land or other purpose. It should not be used to plant crops because deep roots will be impeded from growing and plowing may uncover solid waste.

Inspect the access road once a month and after heavy rains. Repair eroded areas with soil, sand, and gravel, or equivalent.